Canadian Council of Forest Ministers
Conseil canadien des ministres des forêts

Adapting Sustainable Forest Management to Climate Change:

A Systematic Approach for Exploring Organizational Readiness

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Adapting Sustainable Forest Management to Climate Change:
A Systematic Approach for Exploring Organizational Readiness

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"Consideration of climate change and future climatic variability is needed in all aspects of sustainable forest management"

A vision for Canada's forests: 2008 and beyond

(CCFM 2008)

Photo: Natural Resources Canada

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Photo: Kelvin Hirsch

FOREWORD

Canada has 397 million hectares of forests and other woodlands, representing 10% of the world's forest cover. Our forests constitute a world-class natural treasure providing ecological, economic, social, and cultural benefits to all Canadians, regardless of whether they live in small northern communities or large urban centres. Canada is committed to sustainable forest management, which aims to maintain and enhance the long-term health of forested ecosystems while providing ecological, economic, cultural, and social opportunities for present and future generations.

One of several factors that pose both opportunities and challenges in terms of effectively and efficiently meeting our sustainable forest management goals is climate change and its inherent uncertainties. The Canadian Council of Forest Ministers (CCFM) identified climate change as one of two priority issues for Canada's forest sector. In its *Vision for Canada's Forests: 2008 and Beyond*, the CCFM stated, "Consideration of climate change and future climatic variability is needed in all aspects of sustainable forest management." In addition, to minimize the risks and maximize the benefits associated with a changing climate, provincial and territorial premiers, members of the Council of federation, asked their Ministers responsible for forest management to collaborate with the federal government on adaptation in forestry through the CCFM's Climate Change Task Force. Phase 1 of this work, completed in 2010, involved a comprehensive assessment of the vulnerability of various tree species and identified management options for adaptation. Phase 2 has gone beyond the level of trees to look at climate change adaptation within forest ecosystems and the broader forest sector. The goal of phase 2 was to equip members of the forest sector with a suite of tools and state-of-the-art information to enable them to make better decisions about the need for adaptation and the types of measures that may be most beneficial.

Over a period of two years, nearly one hundred individuals from a wide range of organizations have contributed to achieving this goal. The fruits of their labour have been captured in the CCFM's Climate Change Adaptation series, which comprises several technical reports and review papers. It is our sincere hope that these documents, which will be used in conjunction with workshops, seminars, and presentations, will benefit forest practitioners from coast to coast to coast as they seek innovative ways to adapt sustainable forest management policies and practices for a changing climate.

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ABSTRACT

Any organization planning to proactively manage for climate change effects needs a game plan. A crucial first step is to identify the strengths and capabilities, along with weaknesses and gaps, that will affect the organization's readiness to respond to the challenges of climate change. The organizational readiness of any business or other entity is based on its own combination of institutional structure and function, financial resources, acquisition and use of information, know-how, and adaptive decision making. Given that Canada is an ecologically diverse, multijurisdictional country, a single prescriptive approach to evaluating organizational readiness to address climate change is impossible. This report describes a systematic approach that practitioners can use to develop and answer a specific suite of questions that will in turn help them to assess their respective organizations' readiness to adapt to the effects of climate change.

Key words: adaptation, climate change, organizational readiness, institutional function, values, trust, partnership, leadership, information management, ecosystem

RÉSUMÉ

Toute organisation qui entend gérer de façon proactive les changements climatiques a besoin d'un plan de match. La première étape cruciale consiste à déterminer les forces et les capacités — ainsi que les faiblesses et les lacunes — qui affecteront la promptitude de l'organisation à réagir aux défis que posent les changements climatiques. La préparation organisationnelle de toute entreprise ou autre entité est basée sur sa combinaison propre de structure et de fonction institutionnelle, de ressources financières, d'acquisition et d'utilisation de l'information, de savoir-faire et de gestion adaptative. Étant donné la diversité écologique du Canada et de son caractère multijuridique, il est impossible d'évaluer la préparation organisationnelle aux changements climatiques avec une approche unique d'évaluation normative. Ce rapport décrit une approche systématique dont les praticiens peuvent se servir pour poser et résoudre les questions spécifiques qui leur permettront d'évaluer l'état de préparation de leur organisation respective à l'égard de l'adaptation aux effets des changements climatiques.

Mots clés : adaptation, changements climatiques, préparation organisationnelle, fonction institutionnelle, valeurs, confiance, association, leadership, gestion de l'information, écosystème

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EXECUTIVE SUMMARY

A question facing every organization that is committed to sustainable forest management is whether it is capable of responding to the challenges of climate change and other cumulative effects. This report presents an overview of activities and assets that may contribute to an organization's readiness to implement climate-sensitive adaptive management. This organizational readiness represents the convergence of (1) a commitment to "learn while doing" (Lee 1999) and (2) a commitment to the maintenance of the long-term health of forest ecosystems for the benefit of all living things, while providing ecological, economic, cultural, and social opportunities for present and future generations (CCFM 2008).

The organizational readiness of any business or other entity is based on its particular combination of institutional structure and function, financial resources, acquisition and use of information, know-how, and adaptive decision making. The current report presents a framework for exploring various aspects of organizational readiness; however, in recognition of Canada's ecologically diverse, multijurisdictional character, it does not promote a single, prescriptive approach. Rather, this document proposes that an organization can assess its readiness by determining how it is positioned to deliver integrated place- and time-based, community-empowered, and knowledge-driven programs. In recognition of the distinct requirements of provinces, territories, and federal government and the ecosystems for which they have responsibility, these three pillars of integrated programs are considered in terms of 10 themes, which practitioners can use to develop strategic questions for determining organizational readiness. A sample list of key questions for each of the 10 themes is provided in the Appendix.

Place- and time-based perspectives: providing contextual scale

Theme 1: Describe forested ecosystems and other types of planning areas in space and time.

Community-empowered conditions: enabling a coordinated societal response

Theme 2: Use sustainable forest management principles, establish and maintain trusting relationships, engage people, and account for the spectrum of values of natural assets.

Theme 3: Ensure that institutional culture and function can foster an adaptive approach to decision making.

Theme 4: Promote informed leadership.

Theme 5: Create and support the partnerships needed for adaptive decision making and program management.

Knowledge-driven programs: developing and implementing the best mix of tools and techniques

Theme 6: Embrace an ecologically oriented approach to adaptive management by thinking and planning strategically for the long term.

Theme 7: Implement "climate-ready" policy, legislation, and regulation to achieve and maintain sustainable forest management objectives.

Theme 8: Gather knowledge through research, inventory, monitoring, and assessment, and manage this knowledge to support decisions that will reduce the negative effects of climate change and unanticipated outcomes.

Theme 9: Communicate and share knowledge through education, extension courses and other types of community outreach activities.

Theme 10: Implement adaptations into operational practice.

A number of cross-jurisdictional, cross-disciplinary initiatives have already been implemented to address gaps or to tackle barriers. These initiatives include the work of the Intergovernmental Panel on Climate Change, provincial/territorial/municipal strategic plans, and sectoral strategic plans such as the *Vision for Canada's Forests* developed by the Canadian Council of Forest Ministers. For example, the *Vision for Canada's Forests* recognizes the importance of combating the effects of climate change and of balancing ecological, economic, cultural, and social objectives (CCFM 2008). Although it is unlikely that there will ever be a single comprehensive initiative in which interconnected and formally coordinated networks are managed in synchronous unity, organizations can commit to support evolving, empowered, and collaborative approaches to decision making. An important first step is to ensure that organizations responsible for mainstreaming climate change into existing and new programs are equipped to do so.

Literature Cited

[CCFM] Canadian Council of Forest Ministers. 2008. A vision for Canada's forests: 2008 and beyond. Ottawa, ON. 15 p. Also available at: <http://www.ccfm.org/pdf/Vision_EN.pdf>

Lee, K.N. 1999. Appraising adaptive management. Conserv. Ecol. 3(2). <http://www.consecol.org/vol3/iss2/art3>. Accessed 8 July 2011

INTRODUCTION

Sustainable forest management maintains and enhances the long-term health of forest ecosystems for the benefit of all living things, while providing ecological, economic, cultural, and social opportunities for present and future generations (CCFM 2008). The Canadian Council of Forest Ministers committed to sustainable forest management in 1995 and has since developed a suite of programs (CCFM 1997) to balance various sustainability imperatives in the Canadian forest sector. However, the warming and increasing variability of Earth's climate will affect the ways in which organizations practice sustainable forest management (Lemprière et al. 2008; Johnston et al. 2009; Williamson et al. 2009, 2012; NRTEE 2011). Accordingly, managing for climate change effects is now a goal of the Canadian Council of Forest Ministers (CCFM 2008), and adaptation is a principal strategy for meeting that goal. In this regard, a question facing every organization that is committed to sustainable forest management is whether it is ready to respond to the challenges of climate change and other cumulative effects.

There is widespread agreement by scientists and forestry practitioners that preparing for and responding to climate change is necessary and that such preparation includes developing risk management strategies and integrating them into current and new programs. However, climate-sensitive adaptive decision making processes are only now being designed and tested. This report presents an overview of the key concepts that influence the extent to which an organization can adapt its management style to a rapidly changing climate. This overview is a conceptual work developed in concert with other CCFM Climate Change Task Force (CCTF) reports designed to help organizations respond to emerging, often unexpected challenges caused by warming temperatures and changing precipitation patterns.

The essence of adaptation is to "learn while doing" (Lee 1999). In the context of climate change, this adaptive process is characterized by actions to reduce the negative impacts and risks, while increasing the magnitude and likelihood of preferred outcomes (Williamson et al. 2012). Humans have used adaptive behavior to survive and create civilizations for thousands of years, but it was only in the 1970s that a few strategic, forward-thinking scientists (e.g., Walters and Hilborn 1976; Holling 1978; Hilborn 1992; Walters 1997) formally advocated and described the use of experimentation to improve analyses of policy options and decision making in a rapidly industrializing world, where the allocation of natural assets had substantial implications for survival and quality of life. Subsequently, and in recognition of the fact that humans cannot predict the future and will always be called upon to respond to unforeseen events, a sizeable literature has been developed to deal with learning-oriented decision making techniques, including reactive, event-by-event, trial-and-error decision making; iterative decision making; and decision making on the basis of active experiments and comparative analyses.

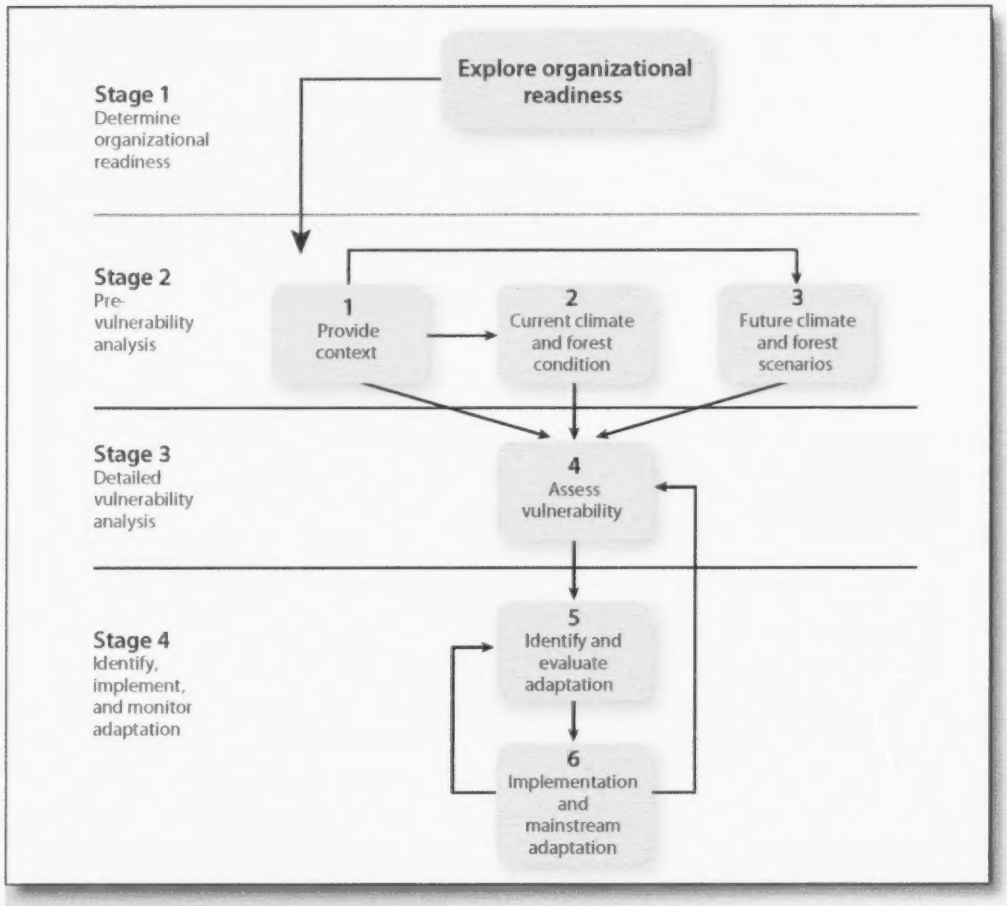

Figure 1. **Components of a framework for exploring organizational readiness, assessing vulnerability, and implementing adaptations.** Diagram reproduced from Williamson, T.B.; Campagna, M.A.; Ogden, A.E. 2012. Adapting sustainable forest management to climate change: a framework for assessing vulnerability and mainstreaming adaptation into decision making. Can. Counc. For. Minist., Otawa, ON. Reprinted with permission from the publisher.

Given the magnitude of ecological, economic, cultural, and social change in Canada, no single decision making approach will equip forest managers to address all of the new and emerging threats to ecosystem function and human health and well-being. In fact, given the variety of uncertainties caused by climate change and other cumulative effects, a truly adaptive organization will ensure that it has access to all available learning-oriented decision making tools and techniques. This report has been prepared to help organizations to assess their capacity or organizational readiness to adopt an adaptive approach to management in the context of a rapidly changing climate. Assessing organizational readiness is an important first step, because adaptive management can involve a host of interrelated activities, such as public engagement, climate modeling, analyses of the vulnerability of natural and social assets, development of adaptation options, decision making, monitoring, and assessment, all of which require support and coordination (Figure 1).

CONCEPTUAL FRAMEWORK TO EXPLORE ORGANIZATIONAL READINESS TO ADAPT

Organizations responsible for the care of natural assets, such as government agencies and forestry companies will be expected to respond to the challenges of climate change. A first and necessary step for any such organization is to determine the capacity to meet emerging challenges by assessing readiness to adapt to change.

Generally, the readiness of an organization to adapt to any type of change is based on its particular combination of institutional structure and function, financial resources, acquisition and use of information, know-how, and adaptive decision making. This document proposes that an organization can assess its readiness to adapt by determining how it is positioned to deliver integrated programs that are place- and time-based, community-empowered, and knowledge-driven (Figure 2). The document presents a framework for exploring various aspects of organizational readiness, with the three pillars considered in terms of 10 themes. Practitioners can use these themes to develop strategic questions for determining organizational readiness.

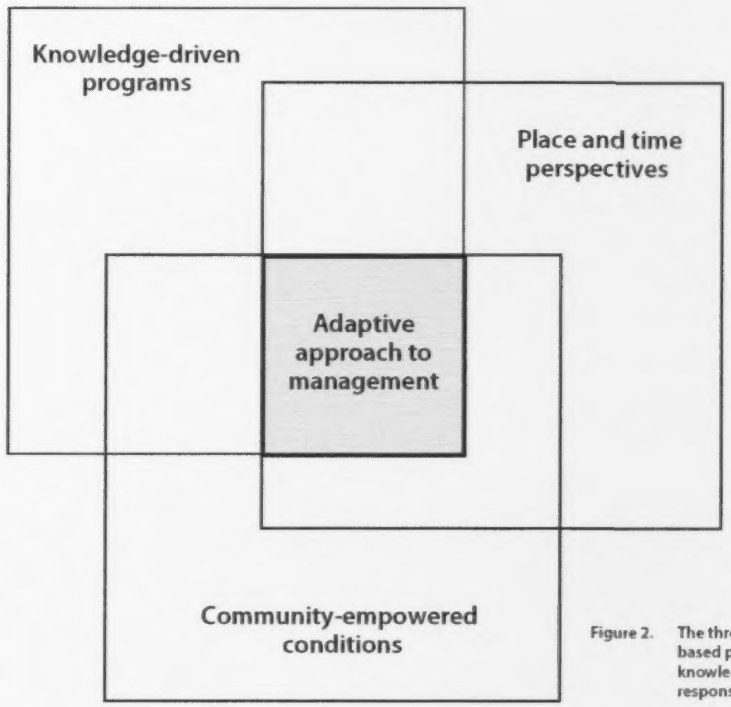

Figure 2. **The three pillars of organizational readiness (place- and time-based perspectives, community-empowered conditions, and knowledge-driven programs) that can support an organization's response to climate change.**

Place- and Time-based Perspectives: Providing Contextual Scale

Theme 1: Describe forested ecosystems and other types of planning areas in space and time.

Community-empowered Conditions: Enabling a Coordinated Societal Response

Theme 2: Use sustainable forest management principles, establish and maintain trusting relationships, engage people, and account for the spectrum of values of natural assets.

Theme 3: Ensure that institutional culture and function can foster an adaptive approach to decision making.

Theme 4: Promote informed leadership.

Theme 5: Create and support the partnerships needed for adaptive decision making and program management.

Knowledge-driven Programs: Developing and Implementing the Best Mix of Tools and Techniques

Theme 6: Embrace an ecologically oriented approach to adaptive management by thinking and planning strategically for the long term.

Theme 7: Implement "climate-ready" policy, legislation, and regulation to achieve and maintain sustainable forest management objectives.

Theme 8: Gather knowledge through research, inventory, monitoring, and assessment, and manage this knowledge to support decisions that will reduce the negative effects of climate change and unanticipated outcomes.

Theme 9: Communicate and share knowledge through education, extension courses and other types of outreach activities.

Theme 10: Implement adaptations into operational practice.

These themes are not mutually exclusive and hence can be explored and evaluated in concert (Figure 3). The following discussion was prepared to help decision makers evaluate the relevance of each theme to their organization as a basis for designing questions that will be used to assess 'organizational readiness' to adapt to the effects of climate change.

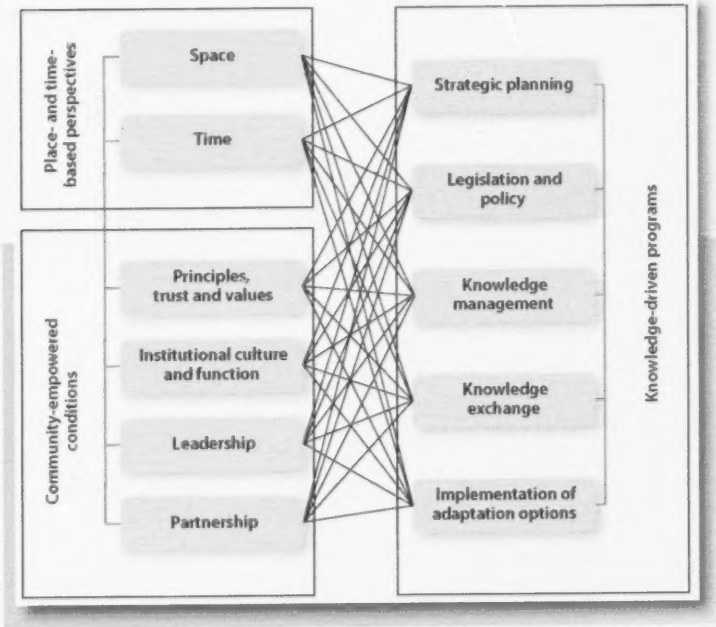

Figure 3. A framework to help organizations that are committed to mainstreaming climate change into decision making programs assess their readiness to manage for climate change. The modules are all linked and can be used in unison to mainstream climate change into decision making programs. Sources: modified from Gray, P.A.; Davidson, R.J. 2000. An ecosystem approach to management: a context for wilderness protection. Pages 59–64 *in* D.N. Cole and S.F. McCool, Eds. Proceedings: Wilderness Science in a Time of Change. US Dep. Agric., For. Serv., Rocky Mtn. Res. Stn., Ogden, UT. RMRS-P-15.Vol. 2. and Environment Canada. 2000. Learning from nature: Canada —the ecosystem approach and integrated land management. Sustain. Dev. Monogr. No. 13. Ottawa, ON. 34 p. Modified and used with permission from the publishers.

PLACE- AND TIME-BASED PERSPECTIVES: *Providing Contextual Scale*

reference to the ecosystems that they use to access ecological goods and services, as well as the communities that rely on those ecosystems. Given that all ecosystems are distinctive, each organization in each province and territory uses a particular suite of spatial and temporal perspectives to catalogue assets, prepare management plans, and make decisions about the use of some of the ecological goods and services.

Theme 1: Spatial and Temporal Context

Sustainable forest management is based on the premise that organizations make decisions and take action with

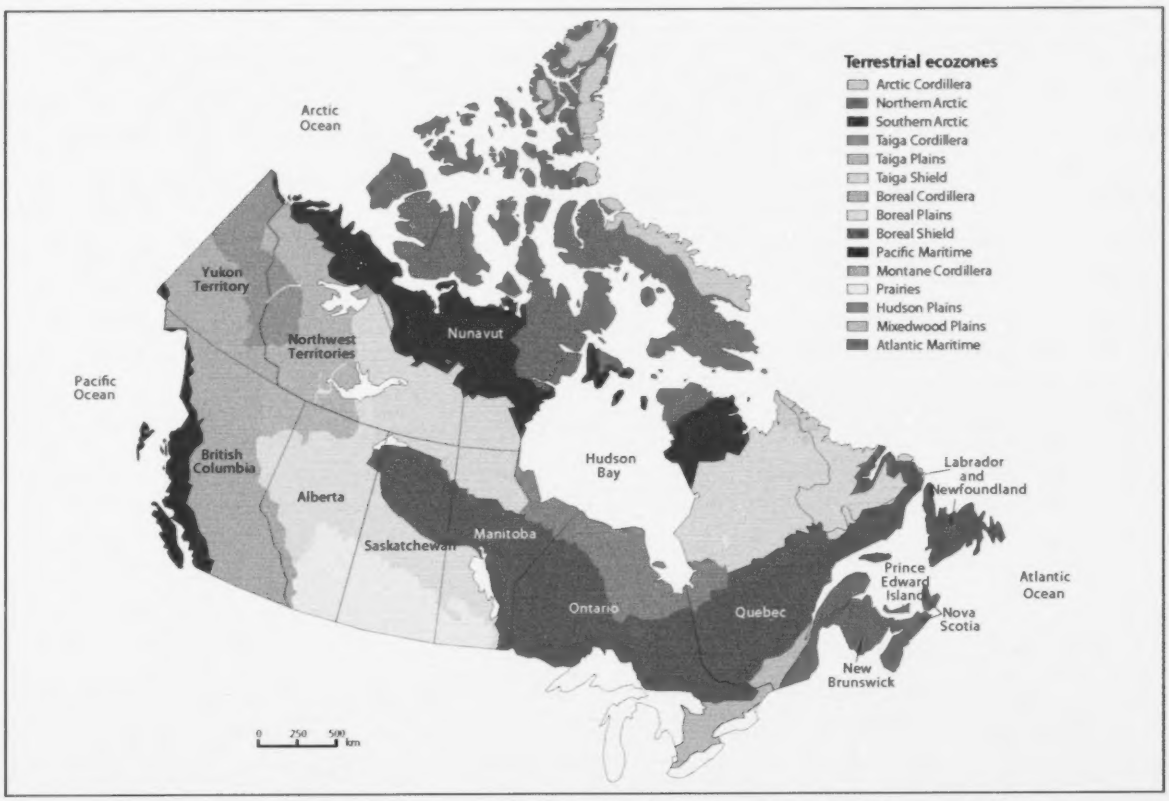

Figure 4. **The terrestrial ecozones of Canada.** This national ecological land classification framework comprises 15 terrestrial ecozones. Each ecozone is an ecologically distinctive area delineated by major biome boundaries. The interaction of human, vegetative, wildlife, climatic, geologic, and physiographic factors leads to further subdivisions: 53 ecoprovinces, 194 ecoregions, and 1020 ecodistricts (CCFM 2006). This hierarchical approach helps natural asset managers to understand and link issues with local to international implications in complex systems of many sizes and shapes. Source: Ecological Stratification Working Group. 1996. A national ecological framework for Canada. Agric. Agri-Food Can. Res. Branch, Cent. Land Biol. Resour. Res., Environ. Can., State Environ. Dir., Ottawa, On. 125 p. Reprinted with permission from the publisher.

In terms of the spatial context, many jurisdictions use a variety of ecological, administrative (e.g., forest management units), jurisdictional (e.g., province), and thematic (e.g., tree species range) units to describe ecological goods and services on maps and with other types of models. Each of these spatial units has its strengths and weaknesses. For example, in contrast to jurisdictional and thematic units, an ecosystem with specific boundaries represents a space within which people from different sectors, with diverse values, can work together to address the spectrum of ecological, economic, cultural, and social factors and forces that affect the condition of natural assets and people's access to ecological goods and services (See Figure 4 for an example of a country-level ecological framework). The definition of such spatial units is especially important in the case of climate change, because temperature, precipitation, and wind affect many ecological processes and the people who depend on them for life and livelihood, including employment. Thematic and jurisdictional perspectives are useful, for example, when making decisions about a particular species that requires accounting for the species' entire range or Canadian distribution. Fortunately, current technologies such as remote sensing and geographic information systems enable organizations to address issues from multiple ecological, jurisdictional, administrative, and thematic perspectives.

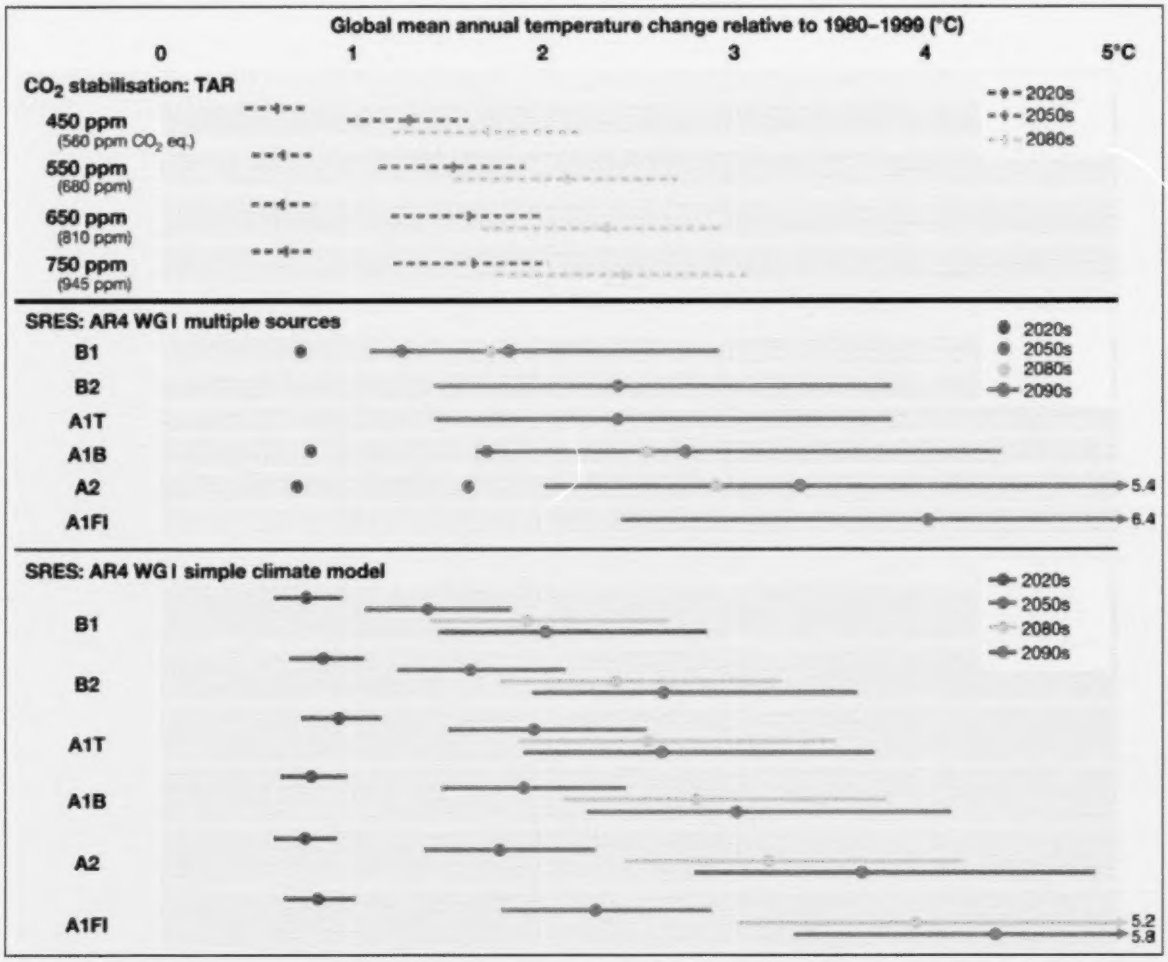

Figure 5. Global mean temperature change associated with certain scenarios from the Special Report on Emissions Scenarios (SRES), which describe the effects of human behavior through the 21st century. TAR = Third Assessment Report; B1, B2, A1T, A1B, A2, A1F1 = scenario designations; AR4 WGI = Assessment Report 4 of Working Group I. Source: Figure TS.4 *in* Parry, M.L.; Canziani, O.F.; Palutikof, J.P.; van der Linden, P.J.; Hanson, C.E., Eds. 2007. Climate change 2007: impacts, adaptation, and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge Univ. Press, Cambridge, UK, and New York, NY. 976 p. Reprinted with permission from the publisher.

Time represents another important scale in scientific investigation, modeling, adaptive decision making, and monitoring. For example, some provinces and territories are committing to short- and long-term objectives for reducing greenhouse gas emissions, which will be achieved over various time scales. Climate modeling is routinely carried out for periods that extend to the end of the 21st century or beyond (Figure 5). As is only logical, sustainable forest management is implemented according to ecological time, which is based on ecological processes that range from a few seconds to thousands of years. Using ecological time, sustainable forest management can be configured to simultaneously address ecological and social processes, as well as the lag effects associated with change. For example, and notwithstanding the potential influences of climate change on the distribution and abundance of plants, the period of natural succession of many Canadian forested ecosystems toward a notional climax exceeds 100 years following disturbance.

The federal government, provinces, territories, and the municipalities manage for the diverse effects of climate change and seek solutions at many spatial and temporal scales. As such, some degree of coordination makes sense, because isolated policy decisions at multiple scales in any type of spatial framework could jeopardize the long-term health of ecosystems as well as the economic, social, and cultural well-being of communities that rely on them. For example, decisions about human activities that are applicable to small ecosystems could be overridden by (or conflict with) other decisions guiding human behavior in larger ecosystems of which the smaller ecosystems are a part (Figure 6).

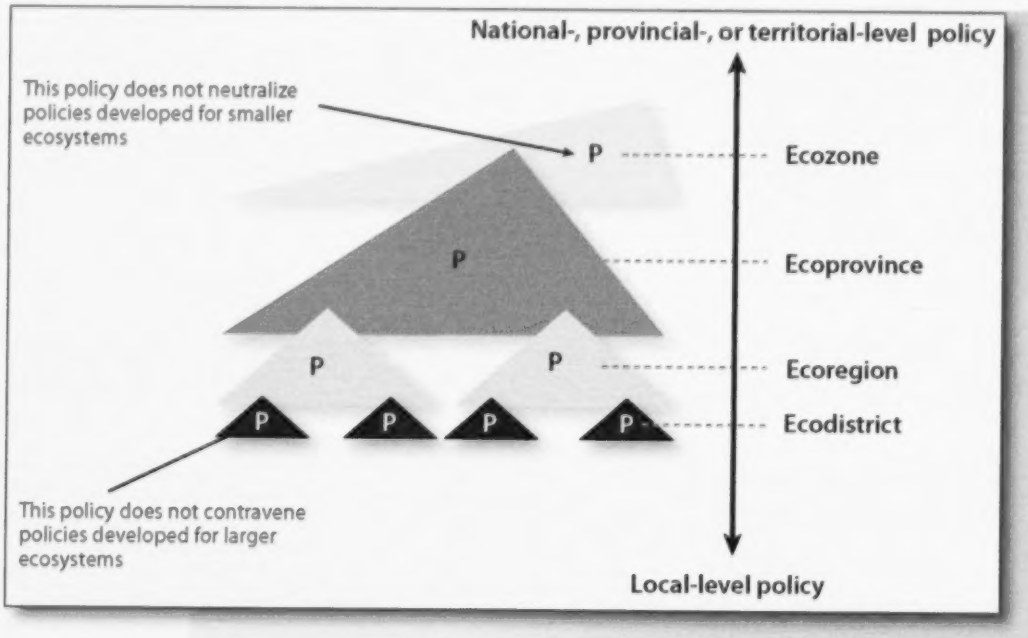

Figure 6. Using ecological land classification nomenclature (see Fig. 4), this graphic illustrates how policies (designated by "P") for smaller ecosystems nest within those for larger ecosystems. Use of a hierarchal classification system allows natural asset managers to design and deliver programs within ecologically meaningful "chunks" of space and time. For example, policy development can be coordinated and integrated to ensure that national and provincial or territorial policies complement area-specific policies and vice-versa.

Photo: Natural Resources Canada

COMMUNITY-EMPOWERED CONDITIONS: *Enabling a Coordinated Societal Response*

Theme 2: Principles, Trust, and Values

People represent a powerful and creative force in the ecosphere (IUCN/UNEP/WWF 1991). The actions of this force are determined by what individuals, families, cultures, and societies understand and believe. Since the beginning of the agricultural revolution, the human population has had a critical role in shaping the composition, structure, and function of the ecosphere, and with that power has come responsibility. Accordingly, adaptive sustainable forest management in the context of a rapidly changing climate is as much about adopting a set of principles, establishing and maintaining trust, ensuring meaningful engagement, and fully valuing natural assets as it is about applying a set of planning and management tools and techniques to guide human activities.

Principles

Canada's commitment to sustainable forest management is based on the following five generic principles (CCFM 2008):

1. **stewardship** that incorporates dynamic, ecosystem-based management; conservation of biodiversity, biogeochemical cycles, soil, and water assets; and sustainable use of ecological goods and services;
2. **innovation** through research, experimentation, and empowerment;
3. **transparency** to ensure that society's social values are reflected and that there is accountability for decision making;
4. **partnership** that includes public engagement and involvement of Aboriginal peoples; and
5. **accessibility** that ranges from Canadians' right to information to opportunities for employment.

Given the importance of nimble, forward-thinking, and iterative decision making in a period of rapid climate change, learning is an important foundation upon which to develop and implement an adaptive response and thereby to constantly improve decision making processes. Organizations that also embrace learning as a principle enhance their chances of successfully responding to the challenges of climate change.

Trust, Engagement, and Participation

Decision making in the context of a rapidly changing climate also benefits from the active engagement of people with diverse goals, values, and interests who can work together in trusting relationships to create a civic consciousness that is based on the principles of sustainable living (Putnam 1995; Sparkes 2003). If society trusts in the ability of governments and other organizations to engage citizens in such decision making, and if society also trusts the cultural and scientific knowledge used to inform those decisions, then the chances of successfully implementing truly adaptive decision making are improved.

A "climate-ready" constituency is characterized by citizens who are fully engaged in developing policy options, who understand climate change and the short- to long-term consequences of decision making, and who are comfortable with the process or processes that have been created to monitor and adjust decisions within the context of a participatory democracy (Tompkins and Adger 2004). Such processes may range from easily organized information sessions to complex co-management arrangements.

Values

Given that sustainable forest management aims to provide fair and equitable distribution of the benefits derived from Canada's vast forested ecosystems (CCFM 2006), the forest sector is positioned to lead the way in developing and applying climate-sensitive adaptive approaches to management. Traditionally, society has valued ecosystems primarily for their contribution to economic and material well-being. However, this perspective is changing in response to a growing recognition that ecological goods and services shape and affect quality of life and that environmental stewardship is essential to ensure the sustainable use of natural assets (for example, Costanza et al. 1997; Wilson 2008).

Currently, sustainable forest management accounts for ecological goods and services that are part of the commercial economy (e.g., timber products) and other goods and services that are valued for their contribution to ecosystem health (e.g., clean soil, eagle nests) and human well-being (e.g., recreational activities). For example, vegetated land cover helps to regulate water flow and provides habitat, recreation opportunities, natural irrigation, drainage, and navigable transportation. In fact, in addition to the traditional economic benefits drawn from forest products (e.g., timber, pulp, and paper), thousands of nontimber assets, including wild edible foods, biochemicals (e.g., bioplastics, biofuels, and health products such as pharmaceuticals), and landscape and garden products, as well as ecological services, such as biodiversity, clean water, clean soil, and clean air (CCFM 2006), complete Nature's account. Given that most ecological goods and services will be affected by a warming climate, knowledge about how these assets are changing over time will be important to adaptive decision making.

Theme 3: Institutional Culture and Function

In a dynamic world, successful organizations constantly evaluate their respective mandates, core business, relevance, capability, and survivability. Traditionally, public organizations responsible for the management of natural assets have drawn on experience and proven management approaches to plan for the future (Williamson et al. 2009). However, given that the past is not necessarily indicative of the future and given that decision making in the context of a rapidly changing climate involves greater uncertainty, new approaches to decision making and management merit consideration. In this regard, emerging decision making styles will be better served if society understands that past conditions and current trends may not exist in the future and that these changes could have substantial implications for the ecological goods and services that are shaped by forested ecosystems. Organizations that help the public to understand these issues and that provide options to address uncertainty have a better chance of garnering public support and trust during times when difficult policy decisions (and possibly trade-offs) must be made. Trust of and support for new management approaches and decision making strategies in the context of a changing climate involve the following (De Geus 1997a, 1997b; Smith and Maltby 2003; de Loë and Kreutzwiser 2005; Reid et al. 2005):

- consensus-building to promote empowerment and collaborative action;
- provision of information that supports decision making;
- constant monitoring and management of policies and practices to measure success and identify change and/or errors that necessitate revision of decisions;
- efficient procedures to update policies and on-site programs;
- greater openness of the decision making process and its consequences, which requires ongoing involvement by the public, particularly in terms of policy development;
- effective information transfer;
- research and analysis to reduce the scale of risk and uncertainty.

Many types of organizational structures and decision making processes have been used by government agencies, companies, nongovernment organizations, and academic institutions to influence decisions about the allocation of ecological goods and services, as well as to allocate and monitor the goods and services, and/or to respond to these allocations. This multiorganizational dynamic shapes sustainable forest management in Canada and will be instrumental in the development and implementation of adaptive strategies in the context of a rapidly changing climate. Given the uncertainty surrounding the impacts of and responses to climate change, interorganizational relationships and

management programs may benefit from sector-level and organization-level adjustments to improve adaptive capacity.

Traditionally, problems with managing natural assets have arisen because of extremes in how decision making systems are organized: either overly centralized (monocentric) or overly decentralized (polycentric) (Reid et al. 2005). Current systems of accountability in most sectors, including sustainable forest management, require that legislative authority rest with a person or agency at a high governmental level. This allows monocentric agencies to more easily focus on implementing and enforcing policy and legislation. At the other end of the continuum, the advantages of a polycentric approach include sharing the responsibility for decision making among multiple centres or authorities (Tompkins and Adger 2004; Lebel et al. 2006), each of which can then work with other larger or smaller organizations having different mandates and related issues. Polycentric institutions are generally better suited to explore issues and to develop and implement policy at multiple spatial and temporal scales.

A matrix structure that draws on the strengths of monocentric, polycentric, and other approaches to decision making may prove to be an effective compromise in managing for the emergent effects of climate change. For example, matrix management can be used to match some of the strengths of traditional hierarchical (monocentric) approaches with the problem-solving capabilities of polycentric teams (Figure 7). The strengths of such a combined approach include coordination of programs to conserve ecosystems, provide multiple services and products, share human resources across service and product lines or themes, facilitate complex decisions, and coordinate shifts in direction (Daft 1989).

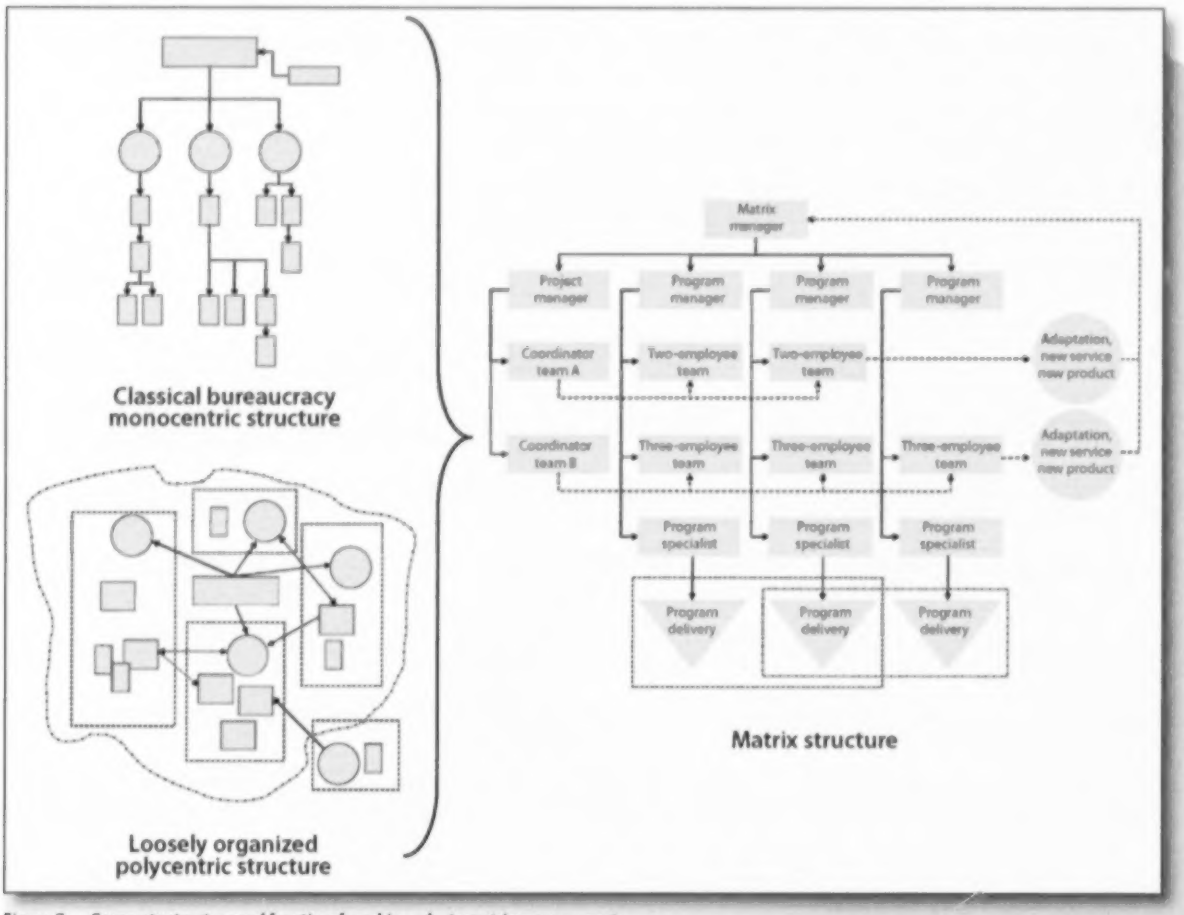

Figure 7. Corporate structure and function: from hierarchy to matrix management.

It is anticipated that institutional culture and function will evolve in various configurations as Canadian jurisdictions and organizations meet the particular challenges of climate change in the ecosystems for which they have responsibility. Generally, an organization that is capable of adaptive management will have many of the following characteristics:

- minimal layers of bureaucracy, thus supporting organizational efficiency and flexibility (Dovers and Handmer 1992);
- coordination of programs with other organizations to reduce the risk of duplication and inefficient administration (Lebel et al. 2006) and to enhance the clarity and directness of joint decisions, which may require specification of power-sharing relationships (Næss et al. 2005);
- ability to ensure that climate change issues are addressed by all programs and projects in the organization as required, by discouraging silos of climate change expertise and know-how (e.g., responsibility for climate change is not assigned to a single department or working group);
- sponsorship of cross-sectoral, cross-disciplinary, and cross-thematic development of policy, strategies, and plans;
- sponsorship or facilitation of empowerment for decision making at the local level while ensuring that the larger provincial/territorial, national, and international issues are addressed (empowerment, which gives people the authority and accountability to do what they are qualified to do, is a logical extension of self-determination and participatory democracy because it places trust and responsibility with individuals; Herbert et al. 2003);
- creation and maintenance of a learning environment that includes and accepts both success and failure as parts of the adaptive process, allowing people to explore opportunities for adaptive change or transformation outside the "normal" range of operations;
- creation or support of a "community dynamic" through which adaptation options that are currently disharmonious with social norms and institutional culture and function can be objectively evaluated and explored (Tompkins and Adger 2004);
- use of a matrix management approach to create and support networks for informal and formal interactions (e.g., De Geus [1997a, 1997b] believed that "organizations that flock learn faster," particularly if the organizations sponsor the work of innovators who can transfer their ideas and inventions to others in the organization or partnership).

Theme 4: Leadership

The ability of an organization to manage for climate change depends not only on how its staff and partners are marshaled and organized to work together, but also on its leadership. Assuming that institutional structure and function support a forward-thinking, adaptive approach (as discussed under theme 3, above), people providing responsible, ethical leadership in the 21st century can be characterized as follows (De Geus 1997a, 1997b; Capra 2002; de Loë and Kreutzwiser 2005; Deloitte 2011):

- recognize the value of ecological goods and services;
- have a vision and foster direction-setting in response to that vision;
- recognize and respond to changes in the world;
- recognize the issues and problems requiring attention, and work to ensure that appropriate resources are allocated accordingly;
- are committed to sustainable living objectives (e.g., sustainable forest management) that include people as an important force in the ecosphere;
- are trustworthy;
- are good communicators;
- value people;
- are prepared to mainstream climate change within research and management programs;
- are able and willing to take advice;
- support lifelong learning;
- support the development and application of innovative ideas, management practices, and product delivery techniques; and
- embrace a multigenerational approach.

In essence, effective leadership ensures that management processes that are designed to guarantee meaningful and ongoing involvement by organizational staff, partners, and the general public and that evolve over time are the norm.

Theme 5: Partnership

No single organization has cornered the market on expertise and know-how in sustainable forest management. Given the scope and complexity of issues with global to local implications, such as climate change, partnerships involving the entire forest sector are important to an adaptive approach to managing for climate change. In fact, a culture of collaboration is key to successful management of climate change: in this context, there is certainly truth in the old adage about strength in numbers. Potential partners include governments, Aboriginal peoples, private woodlot owners, forest products companies, forest-based communities, professional associations, researchers and educators, the environmental community, nontraditional partners (including the energy, chemical, and pharmaceutical industries), and the public.

It is generally accepted that open and fair process-oriented organizations are characterized by partnerships (e.g., advisory committees and working groups) that actively involve citizens in caring for natural assets. Furthermore, successful partnerships of this kind are characterized by commitment, flexibility, awareness of the mission and needs of all involved, early and frequent communication, empowerment, humility, equity, active participation, and an appreciation of what cooperative relationships can do in support of an adaptive approach to management through new or enhanced services and products (NRPTF 1992; US Fish and Wildlife Service 1994; Trauger et al. 1995; Burton et al. 2003; Chambers and Beckley 2003; Nelson et al. 2003). In practice, the chances of successful partnerships are improved if the following conditions are met:

- Organizations clearly define and describe the programs requiring partnerships, because such clarity is needed for the formation of effective partnerships.
- Partnerships are formed between committed organizations that jointly develop a shared vision and common goals, can apply the required level of expertise and knowledge to the tasks for which they are assuming responsibility, and are willing and able to commit staff and resources (including funding) to the programs.
- An acceptable partnership agreement, including rules of conduct, is put into place.
- Tangible services, products, or experiences are required as outputs of the partnership.

Effective partnerships require constant attention and must continually move forward or they will wither away (NRPTF 1992).

Photo: Natural Resources Canada

Photo: Kelvin Hirsch

KNOWLEDGE-DRIVEN PROGRAMS:
Developing and Implementing the Best Mix of Tools and Techniques

Theme 6: Strategic Planning

Strategic planning is used to identify, establish, and modify short- and long-term direction in support of an organization's vision for the future. Strategic planning is used both as a catalyst for change and as a tool to manage for change, and can provide a foundation for mainstreaming adaptation into processes for sustainable forest management decision making. For example, the Vision for Canada's Forests (CCFM 2008) encourages domestic and international engagement, promotes partnerships among traditional and nontraditional interests, and inspires creative responses by partners. In essence, the Vision reflects the collective ambitions of Canadian governments for their forests and communities and creates a foundation from which all can share and draw on one another's strengths and expertise. With respect to climate change, the Vision encourages the implementation of innovative policies and actions to mitigate the effects of greenhouse gas emissions from the forest and to allow adaptation to the effects of climate change on the forests (CCFM 2008).

An organization that subscribes to strategic planning employs a variety of tools and techniques to identify known and potential vulnerabilities to current and future conditions (Williamson et al. 2012). For example, the Intergovernmental Panel on Climate Change and many other organizations around the world use scenarios of human behavior spanning 100 years or more to drive climate models identifying a range of potential future conditions (Nakićenović et al. 2000; Price and Isaac 2012). Such climate scenarios (see, for example, Figure 8) are then used to identify potential future vulnerabilities, the degree to which a system or community is susceptible to, or unable to cope with, the adverse effects of climate change. Several federal, provincial, territorial, and regional agencies in Canada use models and scenarios to project future climate and ecosystem conditions as an aid to understanding the potential effects of climate change. Although it is not known which, if any, of these scenarios will actually occur, strategic, forward-thinking decisions will improve the likelihood that the best mix of adaptation tools and techniques are implemented in support of the health and well-being of current and future generations.

Photo: Natural Resources Canada

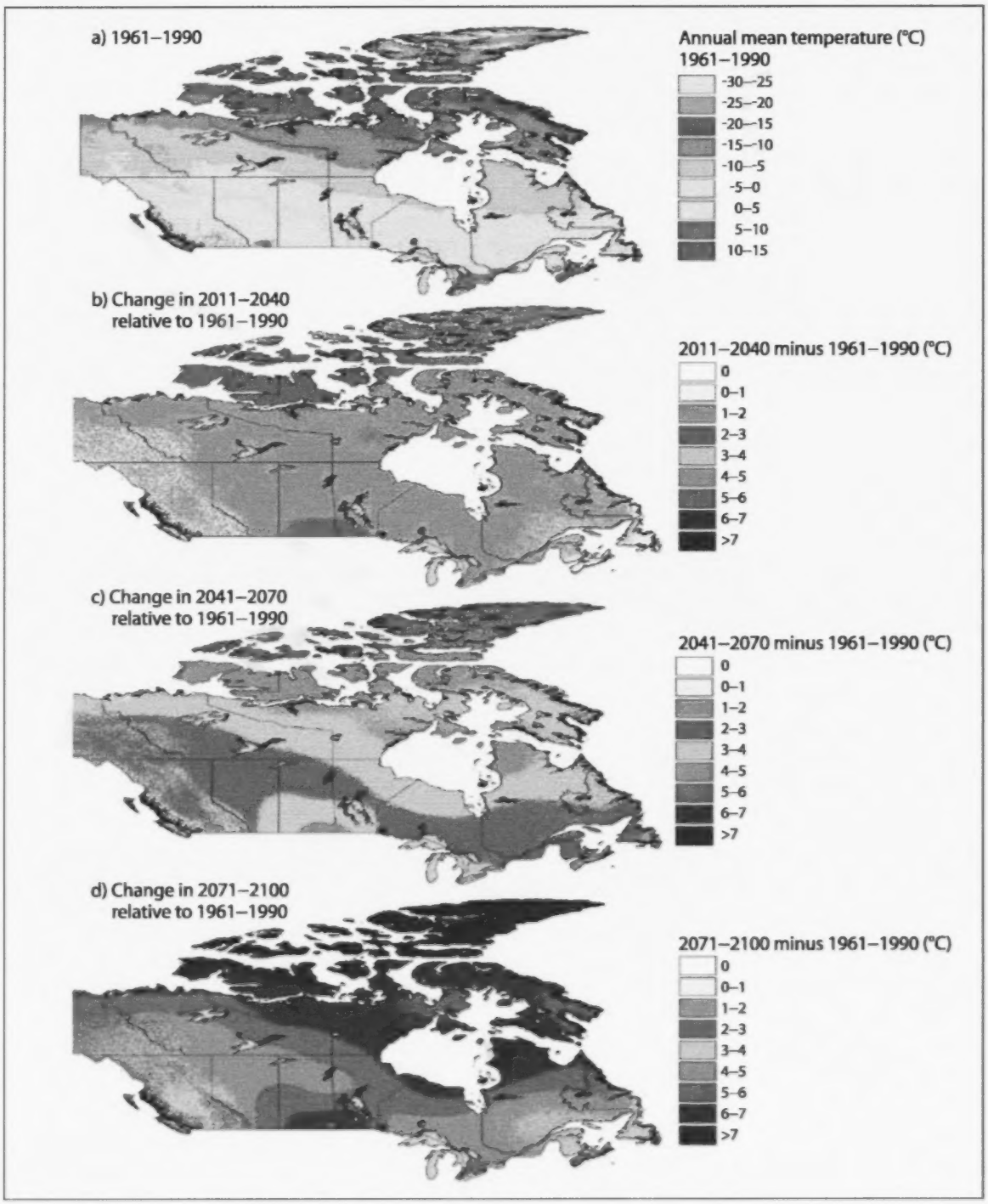

Figure 8. **Examples of spatial and temporal variation in projected future changes in annual mean temperature for Canada, according to the Canadian Second-generation Coupled Global Climate Model.** Recent (1961–1990) annual mean temperature (a) and change, relative to 1961–1990, for 2011–2040 (b), 2041–2071 (c), and 2071–2100 (d). Source: Lemprière, T.C.; Bernier, P.Y.; Carroll, A.L.; Flannigan, M.D.; Gilsenan, R.P.; McKenney, D.W.; Hogg, E.H.; Pedlar, J.H.; Blain, D. 2008. The importance of forest sector adaptation to climate change. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB. Inf. Rep. NOR-X416E. Reprinted with permission from the publisher.

Theme 7: Legislation and Policy

Laws, regulations, and policies relevant to sustainable forest management are designed to maintain or enhance the integrity and resilience of forest ecosystems, to ensure the best use of forest assets, and to support the cultural and social aspirations of Canadians (CCFM 2006). Decisions about the allocation of natural assets are complex and are likely to become more so as the population grows, as demand for access to natural assets increases, and as the climate changes. Accordingly, policy and legislation must be kept current and must be responsive if they are to guide activities in Canada's landscapes, waterscapes, and airscapes as ecological, economic, cultural, and social conditions evolve. An effective mix of legislation and policy in a rapidly changing world will have the following attributes:

- acknowledgment and support of sustainable forest management objectives for natural asset and socioeconomic values;
- acknowledgment of the limitations of ecosystems to provide sustainable ecological goods and services;
- compatibility of different government;
- sufficient flexibility to address the surprises (e.g., a dramatic ecosystem transformation where one kind of ecosystem such as a forest underlain with permafrost is transformed into a different ecosystem such as a wetland in response to warming temperatures) caused by changing climatic and economic conditions, as well as other unforeseen factors and forces;
- ability to draw on information derived from adaptation tools and techniques to incorporate new and evolving knowledge about climate change into policy and legislation;
- support of the use of learning-oriented decision making techniques, such as reactive, event-by-event, trial-and-error decision making, iterative decision making, and decision making on the basis of active experiments and comparative analyses;
- use of results-based policy to support a more holistic approach to management and to encourage innovation and ongoing adaptation (e.g., if there has been experimentation on how to achieve desired outcomes and policies, with a basis in on-the-ground experience combined with decision making flexibility and a high level of professionalism); and
- provision for and promotion of innovation and entrepreneurial activities designed to achieve publicly set targets such as approved objectives in forest management plans.

Theme 8: Knowledge and Information Management

The implementation of policy and associated management activities has elements of risk that result from the uncertainty caused by climate change and other forces and factors. Specifically, to improve the chances that adaptive responses will produce the desired results, organizations need to support information management programs designed to discover, retain, use, and share local, traditional, and scientific knowledge about ecosystems and the social systems that affect and are affected by them as the climate changes. Moreover, a suitable information management system will offer increased flexibility and capacity to solve problems and ensure the balanced engagement of interest groups (Tompkins and Adger 2004; Walker et al. 2006). A robust information management system will have the following characteristics:

- It is created and maintained (with ongoing quality control) to provide access to historical and current data and information that are standardized and geo-referenced for aggregation and analyses at various spatial and temporal scales. It can also be used to generate projections of future climate, biological, and socioeconomic conditions.
- It is constantly updated with data and information collected through research and ongoing inventory, monitoring, synthesis, and assessment studies (including case histories).
- It has secure financial support and is fiscally efficient and responsible.
- It is easily accessible to clients, partners, and the general public.

Theme 9: Communication, Education, and Knowledge Exchange

Many Canadians want to be "climate-ready," and effective communication and sharing of knowledge will help them to attain a working level of understanding in this area. Historically, some communications programs in the environmental disciplines have failed because of complicated, often confusing messaging. These problems are compounded by the scope and complexity of the impacts of climate change on Earth's ecosystems. As one solution, Schramm and Hubert (1996) suggested that organizations use simple messages, avoiding complex jargon wherever possible. In the case of sustainable forest management, such messages could be used to clearly articulate the benefits of adaptive responses to climate change.

Given the rate and scope of change in society—as exemplified by evolving values and changing societal structure, improved and new technologies, and increasing knowledge about the composition, structure, and function of ecosystems—education, extension, and training programs, beyond the formal system of high school, college, and university, are an important part of life. Knowledge about climate change is important for members of the public who participate in decision making, particularly in view of the fact that the decisions required will grow increasingly difficult and complex as some natural assets dwindle and access to them is reduced or eliminated. In addition, lifelong learning by natural asset managers is a prerequisite to understanding local-to-global issues, social values and attitudes, new science, new technologies, and evolving management techniques.

Although knowledge and the communication of that knowledge are important components of the "tool kit" used in managing for climate change, knowledge does not automatically lead to action. Community-based social marketing and the formation and maintenance of networks and other forums that allow people engaged in adaptation theory, policy, and implementation to work together will foster knowledge exchange and dissemination, will facilitate continuous learning, and will provide momentum for effective and practical responses (Schramm and Hubert 1996; Parry et al. 2005; Reid et al. 2005).

Theme 10: Implement Adaptation

The first goal of the Vision for Canada's Forests (CCFM 2008) (to "ensure a prosperous and sustainable future for Canada's entire forest sector") is pragmatic, reaffirming a longstanding commitment to sustainable forest management. In contrast, the Vision's second goal (to "become a world leader in innovative policies and actions to mitigate and adapt to the effects of climate change on our forests and forest communities") is transformational in that it calls upon Canadian jurisdictions to operate organizations that continuously learn from the experience of selecting and implementing adaptive management options that are available to them.

Good planning and management translate ecologically meaningful knowledge and socially acceptable values into action that includes access to ecological goods and services while mitigating the risk of negative effects of human use on natural assets (Manning 1994; Janzen 2000). In the context of a rapidly changing climate, effective planning for and management of natural assets aims to maintain ecological sustainability, must be socially acceptable, and will account for known and potential vulnerability of these assets to climate change. Given the complex responses of Canada's ecosystems to climate change, prescriptive, "one-size-fits-all" guidelines and associated products are not the answer. However, a variety of generic tools and techniques, including products sponsored by the Canadian Council of Forest Ministers are available to help tailor and implement adaptive sustainable forest management that best suits the particular conditions of the ecosystem or ecosystems for which particular organizations have responsibility.

There is widespread agreement about the importance of recognizing and preparing for climate change and developing and integrating risk management strategies into current and new sustainable forest management programs, but few adaptive processes have been operationalized to date (Ogden and Innes 2007; Lemprière et al. 2008; Johnston et al. 2009; Williamson et al. 2009). An adaptive management process, such as the one described by Williamson et al. (2012), can help organizations to identify vulnerabilities and engage people in the development of strategic options. The stages of adaptation can include the following:

Stage 1: Determination of organizational readiness

- Assess organizational readiness and, where necessary, improve the capacity to respond.

Stage 2: Preliminary vulnerability analyses

- Provide context by describing the need for an assessment of vulnerability and showing how results of the assessment will be used.
- Assess current forest conditions in relation to the climate.
- Develop scenarios for future climate and forest conditions.

Stage 3: Detailed vulnerability analyses

- Complete analyses of vulnerability of sustainable forest management under current conditions and future scenarios.

Stage 4: Identification, implementation, and monitoring of adaptations

- Use the results of the vulnerability analyses to identify adaptation options and strategies.
- Evaluate and implement the adaptation strategies (see Figure 1).

Photo: Natural Resources Canada

Photo: Kelvin Hirsch

THE FUTURE:
Some Key Challenges

Given our current understanding of the effects of climate change and the magnitude of change that is anticipated, adaptive management will require active and concerted participation by all levels of government, industry, and the public. However, there will be policy gaps, knowledge gaps, and uneven commitment. Furthermore, there will be uncertainty about the way forward and about the correctness of individual decisions. Jurisdictions will need to determine how they will identify and measure success and failure and how they will monitor and assess progress. Organizations will need to circle back to correct their errors and build on their successes. Convergence of action and transformative public engagement, particularly as they relate to policy development and modification, will be helpful.

Although climate change presents daunting challenges, Canadian organizations have a basis for action through their accumulated knowledge and experience, their access to the results of research on adaptive governance structures, and a suite of decision making tools that are (or can be) conducive to an adaptive approach to management. Canadian organizations are well positioned to identify and evaluate the variety of place- and time-based perspectives, community-empowered conditions, and knowledge-driven tools and techniques that will help staff and partners meet the challenges of a rapidly changing climate.

It is unlikely that we will ever develop a single, comprehensive initiative in which all human activities are formally coordinated and managed in synchronous unity. In fact, such an initiative might turn out to present a barrier to action in its own right. Nonetheless, society's response to climate change need not be fragmented or lacking in vision or commitment. Many cross-jurisdictional, cross-disciplinary initiatives have already been implemented to address gaps and tackle barriers, including but not limited to the work of the Intergovernmental Panel on Climate Change and the Canadian Council of Forest Ministers. For example, the *Vision for Canada's Forests* (CCFM 2008) recognizes the importance of combating the effects of climate change and of balancing ecological, economic, cultural, and social objectives. A fundamental challenge facing any organization that is committed to sustainable forest management (which has an embedded requirement to consider future generations) is whether it is capable of responding to the challenges of climate change. Such organizations may elect to continually ask questions to generate insight about the way forward. In support of such a forward-thinking approach, this document has outlined 10 themes to help organizations develop and answer such guiding questions in support of the commitment to address the impacts of climate change.

Photo: Kelvin Hirsch

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GLOSSARY

Adaptation | "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (Parry et al. 2007).

Adaptive capacity | "The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (Parry et al. 2007).

Adaptive management | "A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices" (MEA 2005).

Climate | "Climate in a narrow sense is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. The classical period of time is 30 years, as defined by the World Meteorological Organization (WMO)" (Parry et al. 2007).

Climate change | "Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), which defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'" (Parry et al. 2007).

Climate variability | "Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. The term is often used to denote deviations of climatic statistics over a given period of time (e.g. a month, season or year) from the long-term statistics relating to the corresponding calendar period. In this sense, climate variability is measured by those deviations, which are usually termed anomalies. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability)" (WMO n.d.).

Ecoregion | "Part of an ecoprovince, characterized by distinctive ecological responses to climate, as expressed by vegetation, soils, water, and fauna" (Wiken 1986). Ecoregions are one component of Canada's ecological land classification framework.

Ecosystem | "The interactive system formed from all living organisms and their abiotic (physical and chemical) environment within a given area. Ecosystems cover a hierarchy of spatial scales and can comprise the entire globe, biomes at the continental scale or small, well-circumscribed systems such as a small pond" (Parry et al. 2007).

Ecozone | "A broad, ecologically distinctive area delineated at a subcontinental level and defined by its interaction of human, vegetative, wildlife, climatic, geologic, and physiographic factors. Canada's ecological land classification framework comprises 15 terrestrial ecozones; these are subdivided into 53 ecoprovinces, the ecoprovinces into 194 ecoregions, and the ecoregions into 1020 ecodistricts" (CCFM 2006).

Resilience | "The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change" (Parry et al. 2007).

Scenarios | "A plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined within a 'narrative storyline'" (Parry et al. 2007). Scenarios are not predictions, and they typically do not include prediction errors or likelihoods.

Sustainable forest management | "Management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things while providing environmental, economic, social, and cultural opportunities for present and future generations" (CCFM 2008).

Vulnerability | "The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (Parry et al. 2007).

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APPENDIX

SAMPLE LIST OF KEY QUESTIONS FOR ASSESSING ORGANIZATIONAL READINESS TO ADAPT TO CLIMATE CHANGE

The following questions are presented as examples to help people working in small to large organizations to create and complete a "readiness assessment" tailored to their particular circumstances. Once an organization's staff and partners have created and answered the questions, decision makers will have an idea about organizational strengths, capabilities, weaknesses, and gaps requiring attention. Organizations could, for example, use sequencing or priority-setting methods to enhance the strengths and to reduce and/or eliminate weaknesses and gaps.

The Organization's Mandate

- Is there a commitment to mainstreaming climate change into decision making and programs?

Spatial Factors

- What scales of ecosystem mapping and monitoring are available, and how do mapping and monitoring programs support a transdisciplinary approach to adaptation in a rapidly changing climate?
- What other spatial perspectives (e.g., administrative and thematic units) should the organization use to support adaptive sustainable forest management in a rapidly changing climate?

Temporal Factors

- What time frames are needed to monitor the known and potential impacts of climate change on ecosystem composition, structure, and function?
- What time frames are needed to monitor the known and potential impacts of climate change on economic, cultural, and social values?

Principles

- How do the guiding principles used by the organization support its commitment to adaptive sustainable forest management?
- Should these principles be modified, or should new principles be adopted, to link sustainable forest management with an adaptive approach to managing for the effects of climate change?

Engagement, Trust, and Participation

- How does the organization inspire and build trust in the community?
- How does the organization engage people at local to regional levels to resolve outstanding issues and to encourage collaborative decision making?
- How does the organization measure its success at involving the community in decision making?

Values

- How are the organization's programs designed to accurately and continually account for the current and potential state (value) of its jurisdiction's ecological assets?
- How does the organization support research to determine how known and potential climate change conditions affect the distribution and abundance of ecological goods and services and associated economic, cultural, and social health?
- How does the organization take into account the diverse suite of human values that must be considered in adaptive sustainable forest management?
- How does the organization establish or contribute to ecologically meaningful and socially responsible allocation targets for ecological goods and services such as the provision of clean water, recreational opportunities, and lumber in a rapidly changing climate?

Institutional Culture and Function

- Is the organization structured to work collaboratively?
- How does the organizational structure provide for collaborative management in small to large ecosystems?
- How does the organization's management team provide multidisciplinary, multistakeholder, multisectoral access to scientific, local, and traditional knowledge?
- How does the management process sponsored by the organization provide for ongoing assessment of allocation decisions and for modification of those decisions as the climate changes?

Leadership

- How does the organization inform staff about the tools and techniques of an adaptive approach to management in a changing climate?
- Does the organization sponsor leadership development for its employees, its partners, and the engaged public at large?
- Does the organization support an internal process that gives staff the opportunity to take the time to understand critical issues, including climate change, and, on the basis of this understanding, participate in decision making?

Partnership

- How does the organization work with other organizations to facilitate better decision making at the ecosystem-level of natural asset allocation and management?
- How does the organization work to optimize the involvement of clients and partners in decision making, from conception to implementation, monitoring, and assessment?

- How does the organization ensure that staff and partners responsible for program management have the necessary expertise and resources to complete the required tasks?
- What arrangement between organizations is needed for a collaborative and coordinated approach to adaptive sustainable forest management in a rapidly changing climate?

Strategic Planning

- How does the organization's strategic plan support ecologically meaningful management in a rapidly changing climate?
- How often does the organization revise and update its strategic plan to maintain and/or enhance its relevance in a rapidly changing world?
- How does the organization's strategic plan relate to (1) program-level action plans used for operations and (2) broader, vision-oriented plans?
- What level of research does the organization sponsor to develop threshold standards and targets for selected ecological, economic, cultural, and social values that can be used to assess the viability of a project in the context of climate change and other cumulative effects?

Legislation and Policy

- What are the underlying natural values on which policy and legislation are based, and how will these values change in response to climate change?
- How do current policies sponsored by the organization provide for an adaptive approach to decision making in a rapidly changing climate, and how do they inform adaptive sustainable forest management?
- How does the organization work to coordinate the development and application of ecosystem-oriented policies at small and large mapping scales across organizations and governments?
- What creative policies does the organization support to enable innovators and entrepreneurs to take advantage of emerging transformative and sustainable industries?

Knowledge and Information Management

- How does the organization's knowledge management system support climate-related data and information for use in adaptive sustainable forest management (e.g., to answer questions about how ecosystems are responding to the short and long-term impacts of climate change and what monitoring programs need to be implemented to detect these changes)?
- How does the organization identify and rectify knowledge gaps related to the effects of climate change on natural assets, communities, and industries?
- How does the organization determine if monitoring programs provide reliable and sufficient data and information to help manage for climate change?
- Do clients and partners have access to the organization's data management systems?
- How satisfied are clients and partners with the process giving them access to the organization's data management system?
- How do the organization's monitoring programs relate to federal, provincial/territorial, and municipal collaborative monitoring networks designed to detect change in Canada's ecosystems?

Communication, Education, and Knowledge Exchange

- How do the organization's communication tools and techniques address adaptive sustainable forest management in a rapidly changing climate?
- How does the organization update training programs designed to provide the technical and management skills required to implement ecologically meaningful and socially responsible programs? More specifically, should these programs be adjusted to ensure the integration of complex issues such as climate change?
- How does the organization create and continually enhance education, extension (e.g., outreach programs), and training opportunities for people of all ages? Should these programs be modified to integrate knowledge about climate change into communication products?
- How does the organization incorporate local, traditional, and scientific knowledge into learning programs that address climate change?

Implementing Adaptive Management

- How does the organization establish and measure targets for sustainability, and are these targets relevant in a rapidly changing climate?
- Does the organization use an adaptive management framework?
- How does the organization use an adaptive framework to evaluate and respond to the known and potential impacts of climate change?

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